TOPIC: 291006
KNOWLEDGE: K1.01 [2.7/2.7]
QID: B104

Which one of the following describes the proper sequence for placing a steam (shell) and water (tube) heat exchanger into service?

A. Water side is valved in before the steam side to ensure adequate venting.

B. Water side is valved in before the steam side to minimize thermal shock.

C. Steam side is valved in before the water side to minimize scale buildup on the heat exchanger tubes.

D. Steam side is valved in before the water side to ensure that the cooldown rate does not exceed 100°F/hr.

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.02 [2.6/2.6]
QID: B36

Why is proper venting of a shell-and-tube heat exchanger important?

A. An air bubble reduces the heat transfer coefficient of the heat exchanger.

B. An air bubble causes pressure transients within the tubes as heat load changes.

C. An air bubble will cause thermal shock as it moves through the heat exchanger.

D. An air bubble will cause corrosion in the heat exchanger.

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.02 [2.6/2.6]
QID: B531

A liquid-to-liquid heat exchanger containing trapped air on the shell side will be less efficient because the air...

A. causes more turbulent fluid flow.

B. increases the differential temperature across the tubes.

C. reduces the fluid contact with the heat transfer surface.

D. causes pressure oscillations.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.02 [2.6/2.6]
QID: B932

Reduced heat transfer performance in a heat exchanger will result from...

A. tube wall thinning.

B. turbulent flow in the tubes.

C. increased ΔT between fluids.

D. gas collection in the shell.

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B330

Given the formula, $Q_{core} = \dot{m}_{core}(h_{out} - h_{in})$, which one of the following causes the initial change in heat transfer rate from the core during a minor (3%) steamline break?

A. h_{out} decreases

B. h_{out} increases

C. $\dot{m}_{core}$ decreases

D. $\dot{m}_{core}$ increases

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B631 (P2032)

The rate of heat transfer between two liquids in a heat exchanger will be increased if the:
(Assume single-phase conditions and a constant specific heat for each liquid.)

A. flow rate of the colder liquid is decreased by 10%.

B. flow rate of the hotter liquid is increased by 10%.

C. inlet temperature of both liquids is decreased by 20°F.

D. inlet temperature of both liquids is increased by 20°F.

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B832 (P1632)

The rate of heat transfer between two liquids in a heat exchanger will be <u>decreased</u> if the:
(Assume single-phase conditions and a constant specific heat capacity.)

A. temperature of both liquids is decreased by 20°F.

B. temperature of both liquids is increased by 20°F.

C. flow rate of the colder liquid is decreased by 10%.

D. flow rate of the hotter liquid is increased by 10%.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B1432 (P1432)

The rate of heat transfer between two liquids in a heat exchanger will be <u>increased</u> if the:
(Assume single-phase conditions and a constant specific heat.)

A. temperature of the hotter liquid is decreased by 20°F.

B. temperature of the colder liquid is increased by 20°F.

C. flow rates of both liquids are decreased by 10%.

D. flow rates of both liquids are increased by 10%.

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B1732 (P1732)

Which one of the following will reduce the rate of heat transfer between two liquids in a heat exchanger? (Assume single-phase conditions and a constant specific heat for both liquids.)

A. The inlet temperatures of both liquids are decreased by 20°F.

B. The inlet temperatures of both liquids are increased by 20°F.

C. The inlet temperature of the hotter liquid is increased by 20°F.

D. The inlet temperature of the colder liquid is increased by 20°F.

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B2531 (P2632)

The rate of heat transfer between two liquids in a heat exchanger will be decreased if the: (Assume single-phase conditions and a constant specific heat for both liquids.)

A. inlet temperature of the hotter liquid is increased by 20°F.

B. inlet temperature of the colder liquid is decreased by 20°F.

C. flow rates of both liquids are decreased by 10%.

D. flow rates of both liquids are increased by 10%.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.03 [2.4/2.6]
QID: B3631 (P3632)

Refer to the drawing of an operating water cleanup system (see figure below).

If cooling water flow rate is 1.0×10^6 lbm/hr, what is the approximate water flow rate in the cleanup system?

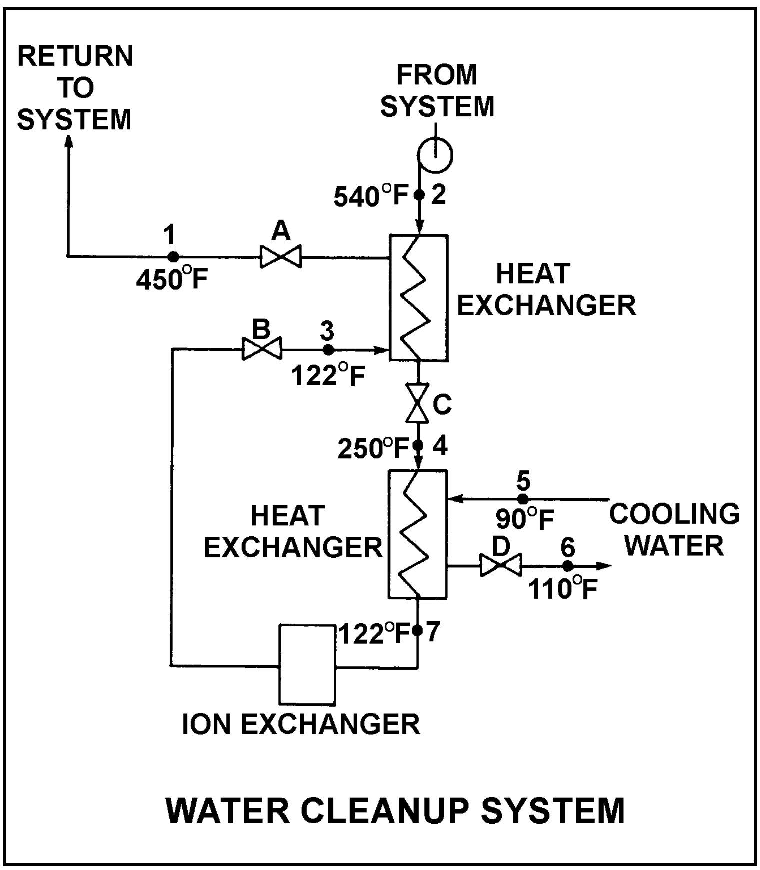
A. 1.6×10^5 lbm/hr

B. 3.2×10^5 lbm/hr

C. 1.6×10^6 lbm/hr

D. 3.2×10^6 lbm/hr

ANSWER: A.



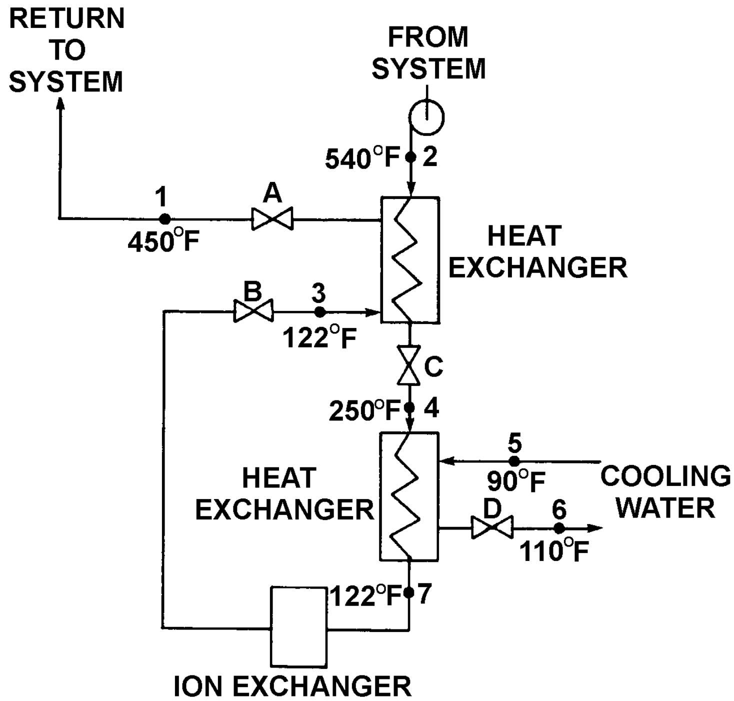
TOPIC: 291006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: B632 (P3232)

Refer to the drawing of an operating water cleanup system (see figure below). Valves A, B, and D are fully open and valve C is 20% open.

If valve C is opened to 50%, how will the temperatures at points 3 and 6 be affected?

	Point 3	Point 6
A.	Decrease	Decrease
B.	Decrease	Increase
C.	Increase	Decrease
D.	Increase	Increase

ANSWER: D.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: B1031 (P1032)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and C are fully open. Valve D is 20% open. All temperatures are as shown. Valve D is then quickly opened to 100%.

The temperature at point...

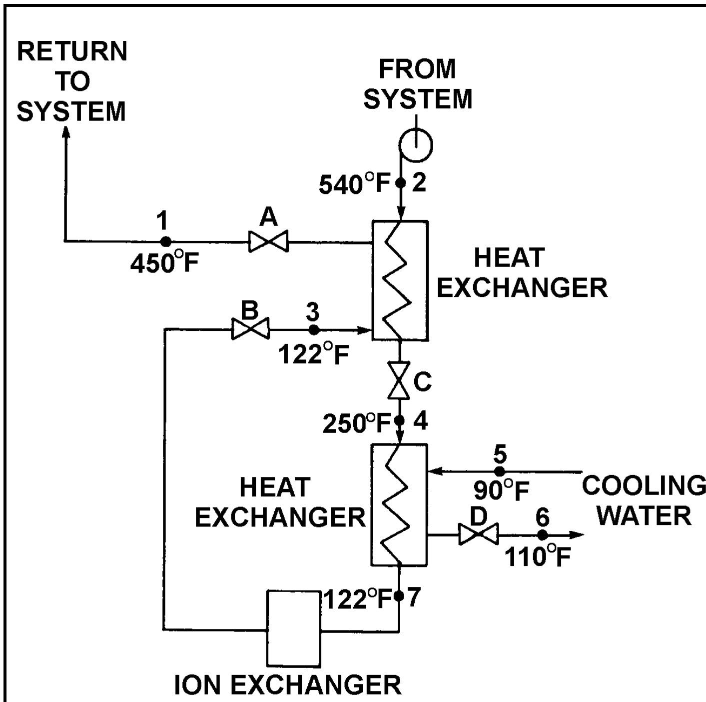
A. 3 will increase.

B. 4 will decrease.

C. 5 will decrease.

D. 7 will increase.

ANSWER: B.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: B1834 (P732)

Refer to the drawing of an operating water cleanup system (see figure below).

Valves A, B, and C are fully open. Valve D is 80% open. All temperatures are as shown. If valve D is then throttled to 50%, the temperature at point...

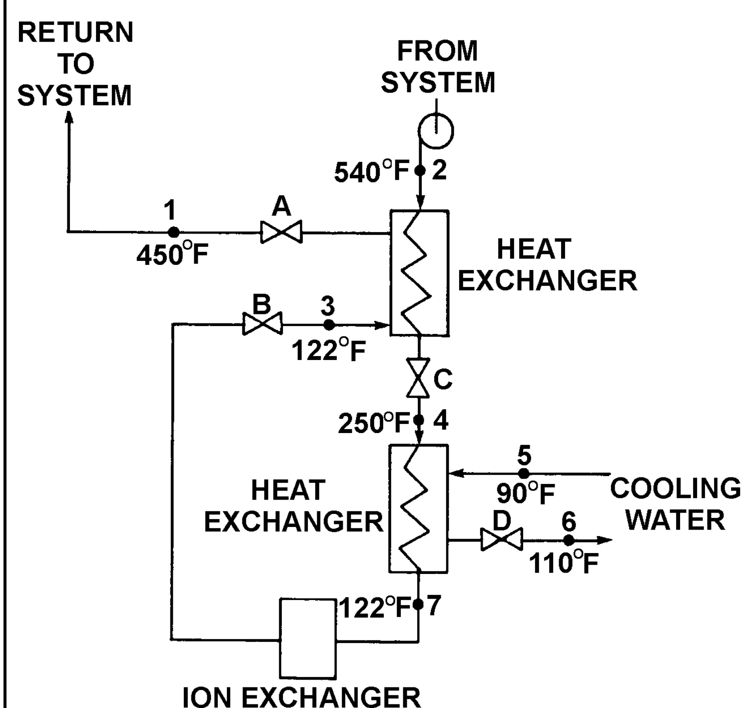
A. 3 will decrease.

B. 4 will increase.

C. 5 will increase.

D. 6 will decrease.

ANSWER: B.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: B1930 (P3332)

Refer to the drawing of an operating water cleanup system. All valves are identical and are initially 50% open (see figure below).

To raise the temperature at point 7, the operator should adjust valve __________ in the close direction.

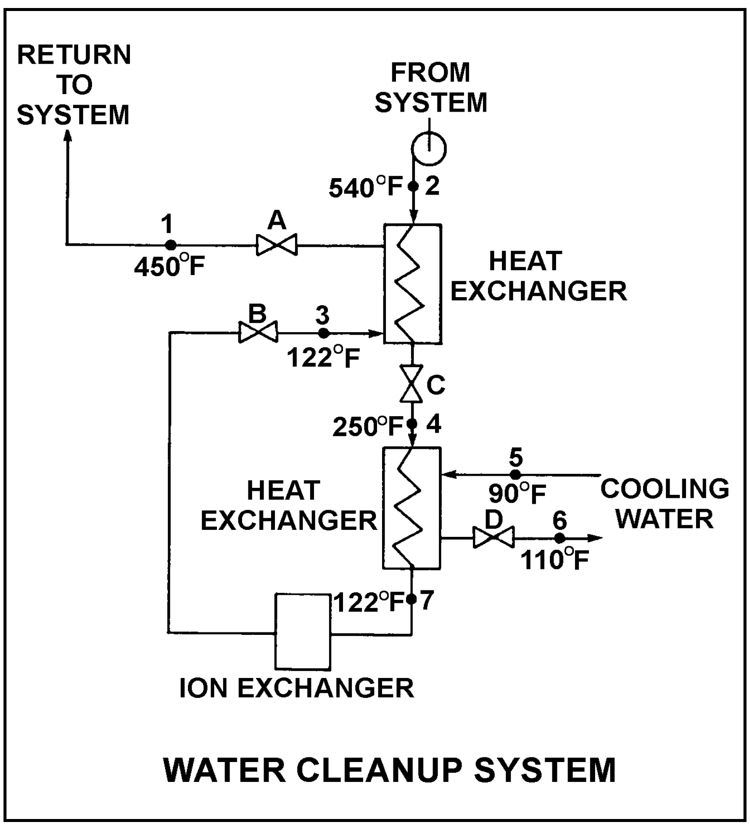
A. A

B. B

C. C

D. D

ANSWER: D.



TOPIC: 291006
KNOWLEDGE: K1.04 [2.8/2.8]
QID: B2431 (P2433)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. To raise the temperature at point 1, the operator can adjust valve ______ in the ______ direction.

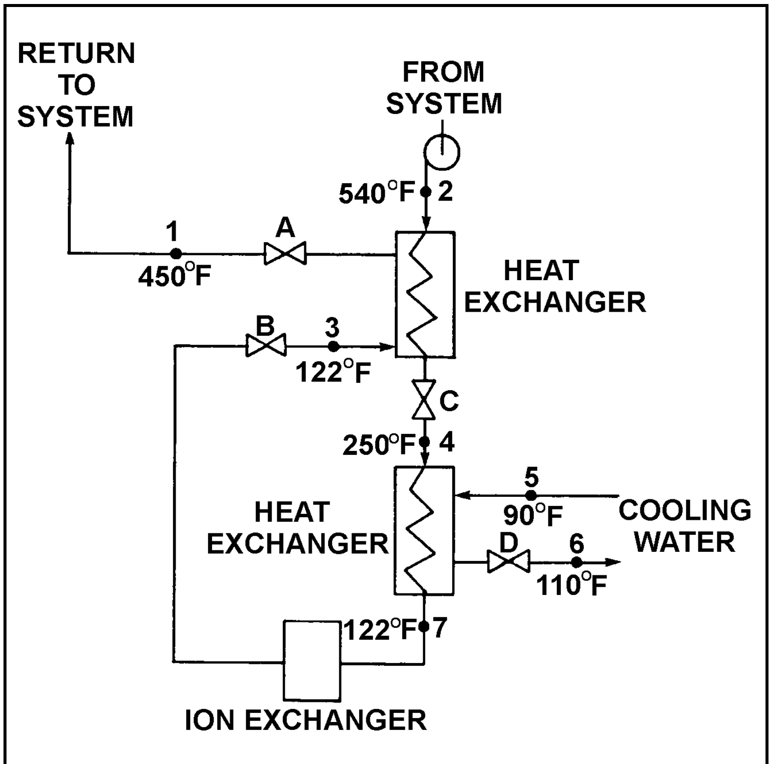
A. A; shut

B. B; open

C. C; shut

D. D; open

ANSWER: B.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B31

Decreasing the temperature of a cooled system using a shell-and-tube heat exchanger is normally accomplished by...

A. increasing the cooling system flow.

B. increasing the cooled system flow.

C. decreasing the cooling system flow.

D. decreasing the cooled system flow.

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.07 [2.9/3.0]
QID: B101

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. The temperature at point 3 is exceeding operating limits. To <u>lower</u> the temperature at point 3, the operator should adjust valve ______ in the open direction.

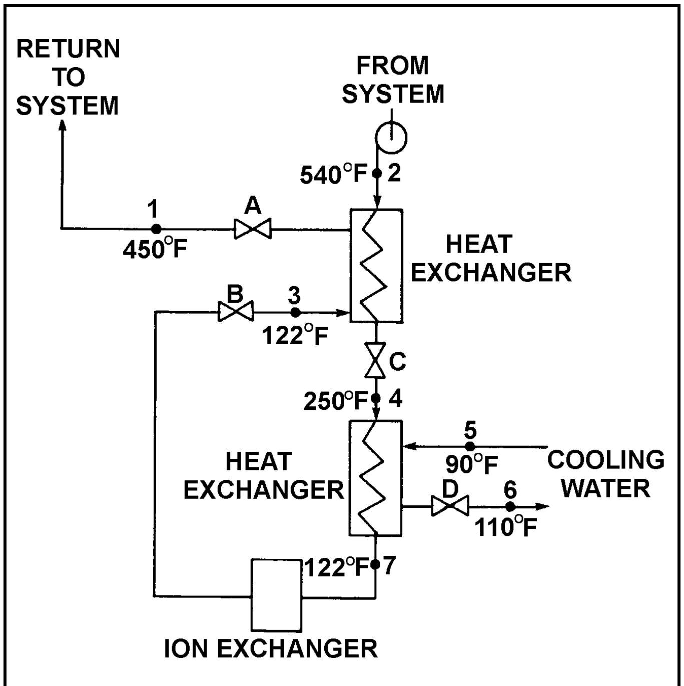
A. A

B. B

C. C

D. D

ANSWER: D.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B231 (P104)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. To lower the temperature at point 7, the operator should adjust valve __________ in the open direction.

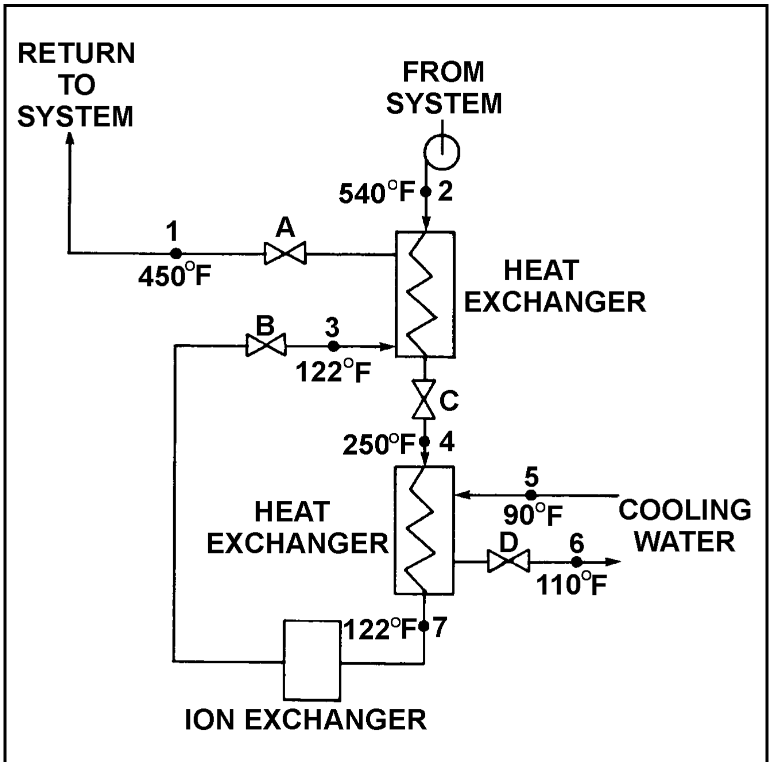
A. A

B. B

C. C

D. D

ANSWER: D.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B1231 (P1231)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. To lower the temperature at point 4, the operator should adjust valve ______ in the ______ direction.

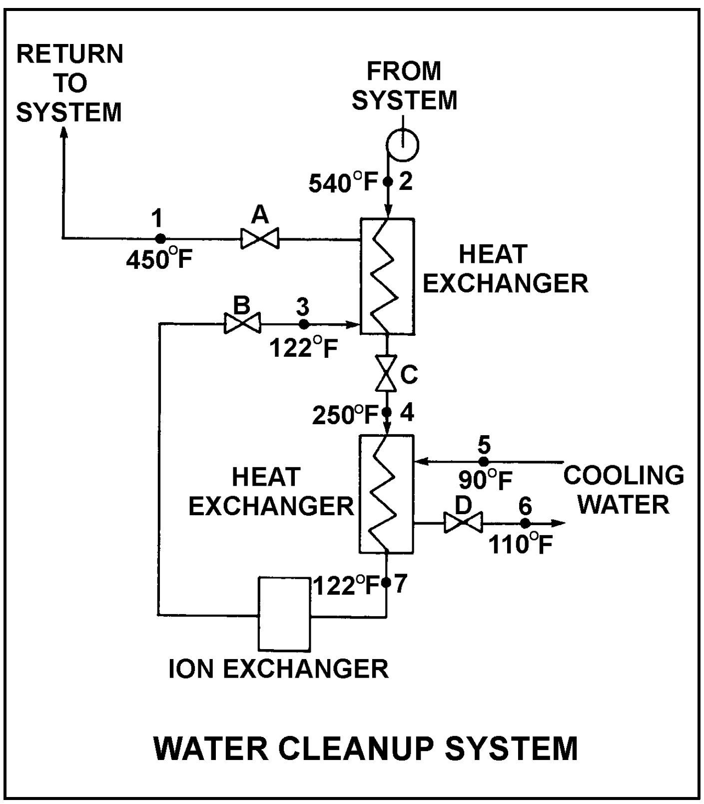
A. A; open

B. B; shut

C. C; open

D. D; shut

ANSWER: B.



TOPIC: 291006
KNOWLEDGE: K1.07 [2.7/2.8]
QID: B2732 (P2732)

Refer to the drawing of an operating water cleanup system (see figure below).

All valves are identical and are initially 50% open. To raise the temperature at point 4, the operator can adjust valve ______ in the ______ direction.

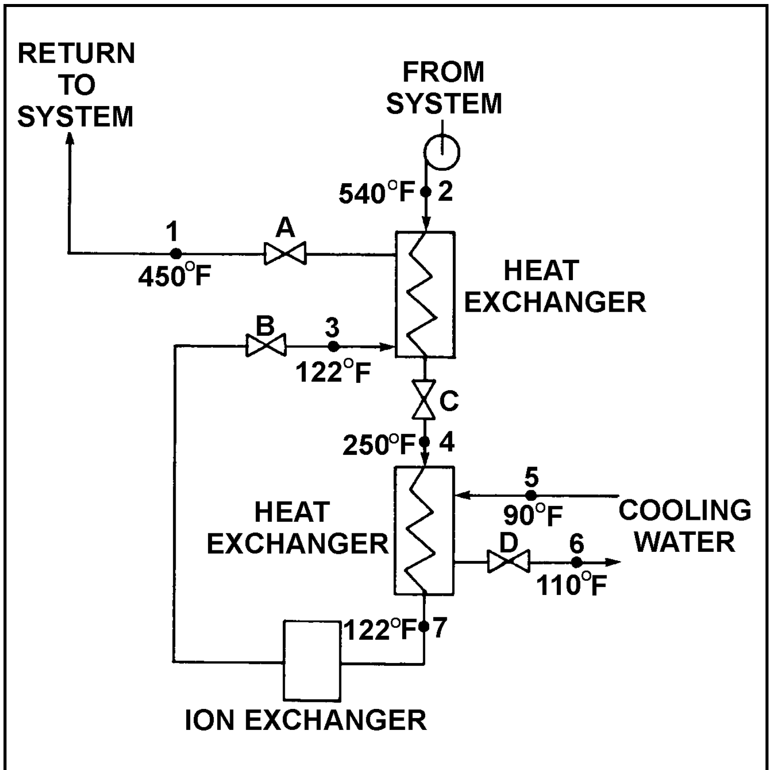
A. A; shut

B. B; shut

C. C; open

D. D; open

ANSWER: C.



WATER CLEANUP SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.07 [2.6/2.8]
QID: B3832 (P3833)

A main turbine-generator was operating at 80% load with the following <u>initial</u> steady-state cooling water and lube oil temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Six months later, the following <u>current</u> steady-state heat exchanger temperatures are observed:

$T_{oil\ in}$ = 177°F
$T_{oil\ out}$ = 111°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume that the total heat exchanger heat transfer coefficient and the cooling water flow rate do <u>not</u> change, and that the specific heat values for the cooling water and lube oil do <u>not</u> change. Also, assume that the lube oil system is a closed system.

Which one of the following could be responsible for the differences between the initial and current steady-state heat exchanger temperatures?

A. The current main turbine-generator load is lower than the initial load.

B. The current main turbine-generator load is higher than the initial load.

C. The current main turbine lube oil flow rate is less than the initial flow rate.

D. The current main turbine lube oil flow rate is greater than the initial flow rate.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B331 (P534)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Increasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _________ and the cooling water outlet temperature to __________.

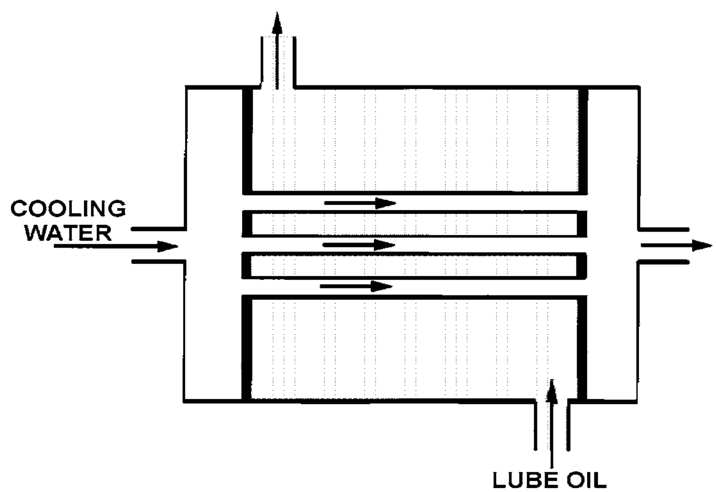
A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: A.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B431 (P632)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Assume that the inlet lube oil and inlet cooling water temperatures are constant and cooling water flow rate remains the same. Decreasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _________ and the cooling water outlet temperature to _________.

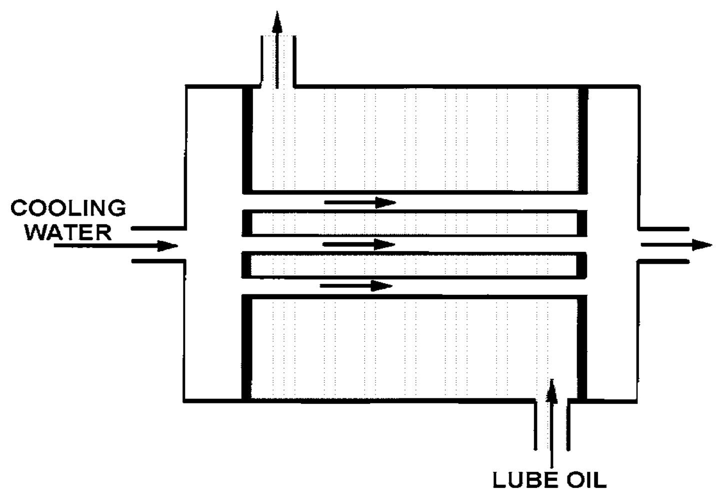
A. increase, increase

B. increase, decrease

C. decrease, increase

D. decrease, decrease

ANSWER: D.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B834 (P2034)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$\dot{Q}_{oil}$ = 9.9×10^5 Btu/hr
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 1.65×10^4 lbm/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 120°F
$T_{water\ out}$ = 110°F
$T_{water\ in}$ = ?

Which one of the following is the cooling water inlet temperature ($T_{water\ in}$) in this heat exchanger?

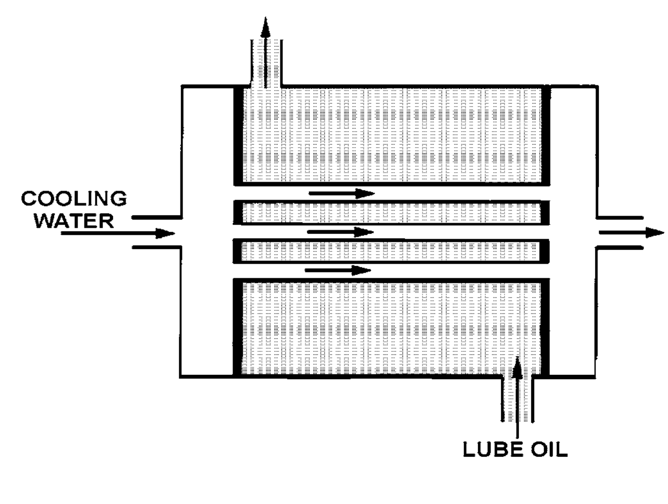
A. 45°F

B. 50°F

C. 55°F

D. 60°F

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B934 (P3132)

Refer to the drawing of a lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following parameters:

$\dot{Q}_{oil}$ = 1.0×10^7 Btu/hr
$T_{oil\ in}$ = 170°F
$T_{oil\ out}$ = 134°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 112°F
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$\dot{m}_{water}$ = ?

Which one of the following is the mass flow rate of the cooling water?

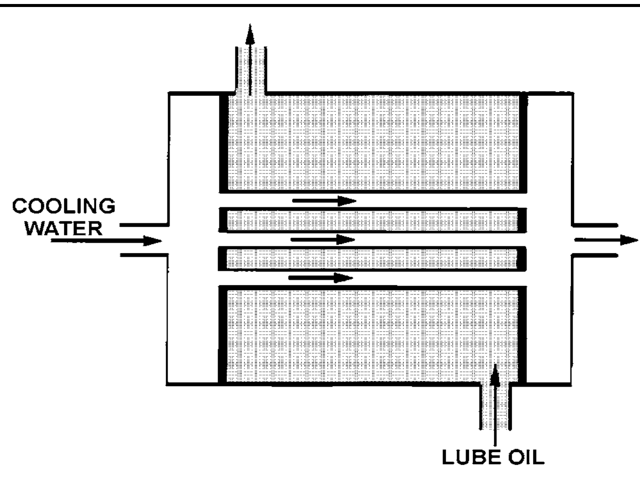
A. 4.5×10^5 lbm/hr

B. 3.7×10^5 lbm/hr

C. 2.5×10^5 lbm/hr

D. 1.2×10^5 lbm/hr

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B1033

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$C_{p\text{-oil}}$ = 1.1 Btu/lbm-°F
$C_{p\text{-water}}$ = 1.0 Btu/lbm-°F
$\dot{m}_{oil}$ = 1.8 x 10^4 lbm/hr
$\dot{m}_{water}$ = 1.65 x 10^4 lbm/hr
$T_{oil\ in}$ = 115°F
$T_{oil\ out}$ = 90°F
$T_{water\ out}$ = 110°F
$T_{water\ in}$ = ?

Which one of the following is the cooling water inlet temperature ($T_{water\ in}$) for this heat exchanger?

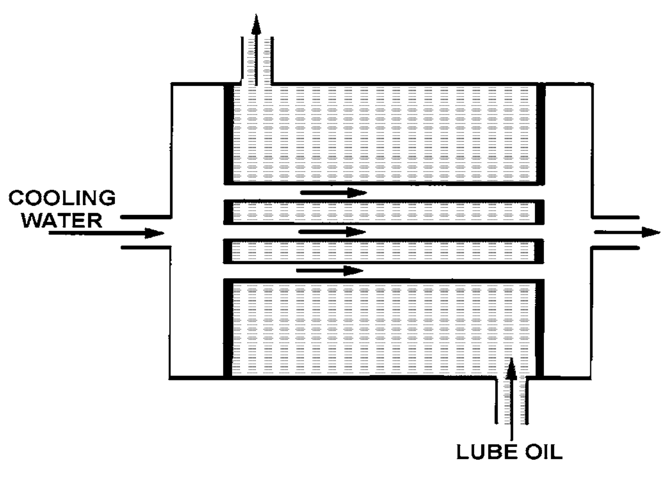
A. 50°F

B. 60°F

C. 75°F

D. 80°F

ANSWER: D.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B1331

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 3.3×10^4 lbm/hr
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 170°F
$T_{oil\text{-}out}$ = ?

Which one of the following is the temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

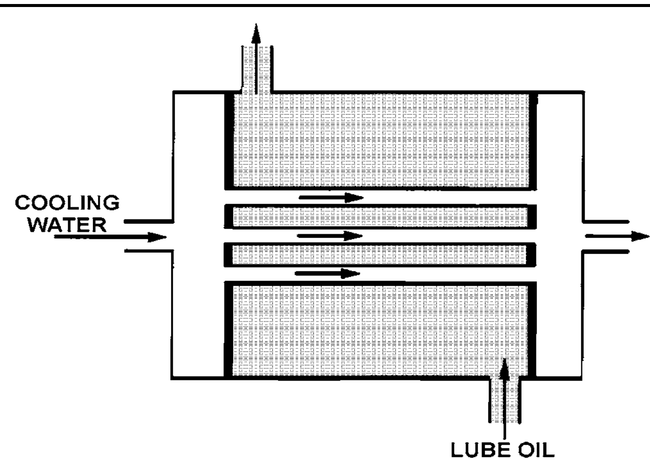
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B1435 (P2232)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 3.3×10^4 lbm/hr
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 170°F
$T_{oil\text{-}out}$ = ?

What is the approximate temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

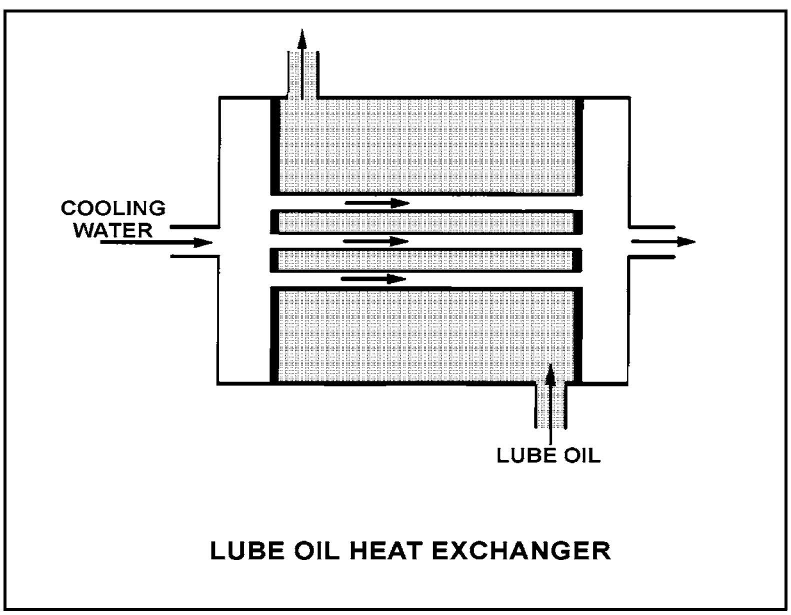
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: B.



TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B1531 (P1533)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following existing conditions:

$\dot{m}_{oil}$ = 1.8×10^4 lbm/hr
$\dot{m}_{water}$ = 3.3×10^4 lbm/hr
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 90°F
$T_{cw\text{-}out}$ = 120°F
$T_{oil\text{-}in}$ = 170°F
$T_{oil\text{-}out}$ = ?

What is the approximate temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

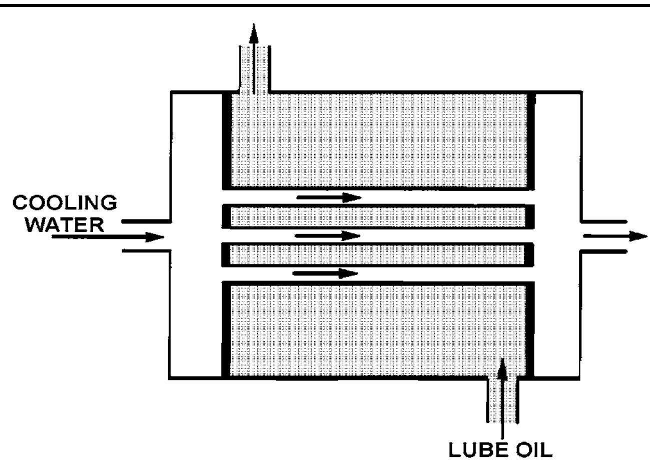
A. 110°F

B. 120°F

C. 130°F

D. 140°F

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B1631 (P1634)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information, which one of the following is the temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

$\dot{m}_{oil}$ = 2.0 x 10^4 lbm/hr
$\dot{m}_{water}$ = 3.0 x 10^4 lbm/hr
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = 125°F
$T_{oil\text{-}in}$ = 180°F
$T_{oil\text{-}out}$ = ?

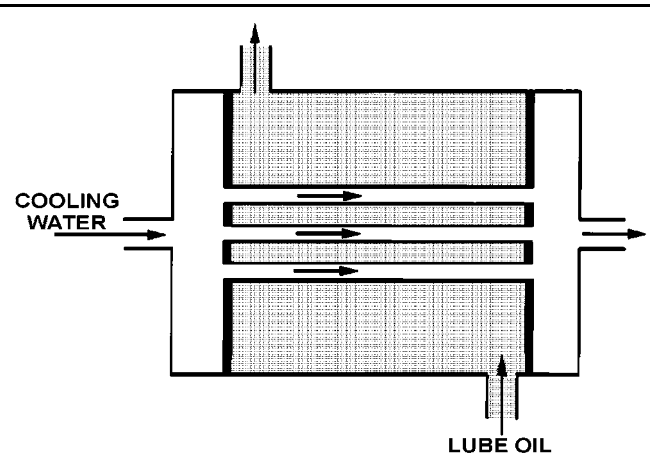
A. 126°F

B. 135°F

C. 147°F

D. 150°F

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B1933 (P1934)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information, which one of the following is the temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

$\dot{m}_{oil} = 1.5 \times 10^4$ lbm/hr
$\dot{m}_{water} = 2.5 \times 10^4$ lbm/hr
$C_{p\text{-}oil} = 1.1$ Btu/lbm-°F
$C_{p\text{-}water} = 1.0$ Btu/lbm-°F
$T_{cw\text{-}in} = 92°F$
$T_{cw\text{-}out} = 125°F$
$T_{oil\text{-}in} = 160°F$
$T_{oil\text{-}out} = ?$

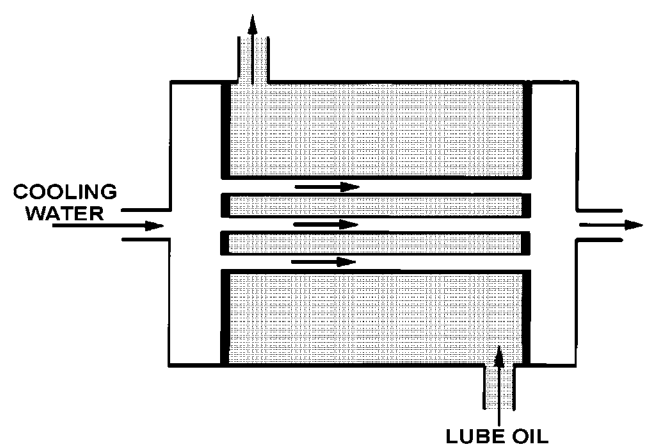
A. 110°F

B. 127°F

C. 135°F

D. 147°F

ANSWER: A.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2132 (P2133)

Refer to the drawing of a lube oil heat exchanger (see figure below).

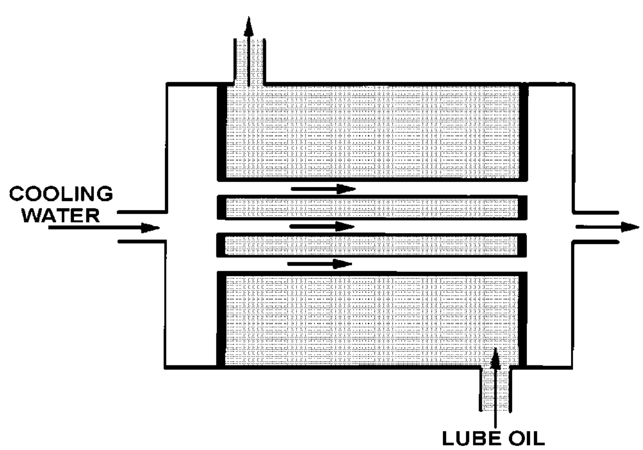
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 120°F
Cooling water inlet temperature: 60°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following sets of heat exchanger outlet temperatures is possible? (Neglect any difference between fluid-specific heats.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	100°F
B.	90°F	90°F
C.	80°F	80°F
D.	80°F	100°F

ANSWER: C.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2233 (P2434)

Refer to the drawing of a lube oil heat exchanger (see figure below).

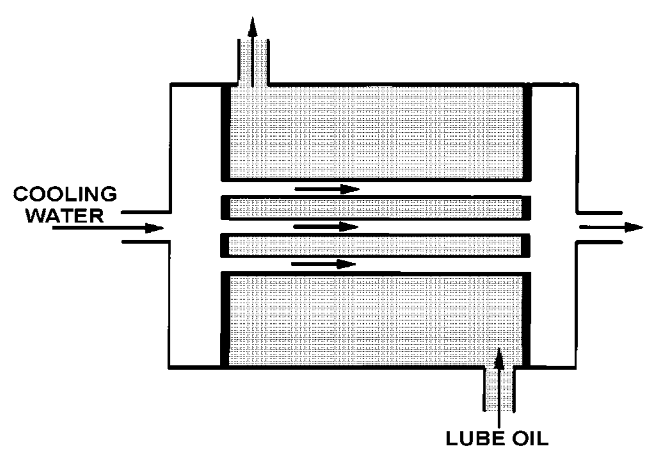
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following sets of heat exchanger outlet temperatures is possible? (Assume both fluids have the same c_p.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	90°F	100°F
B.	90°F	110°F
C.	100°F	100°F
D.	100°F	110°F

ANSWER: A.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2534 (P2532)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following information, which one of the following is the temperature of the cooling water exiting the heat exchanger ($T_{cw\text{-}out}$)?

$\dot{m}_{oil}$ = 1.5 x 10^4 lbm/hr
$\dot{m}_{water}$ = 2.5 x 10^4 lbm/hr
$C_{p\text{-}oil}$ = 1.1 Btu/lbm-°F
$C_{p\text{-}water}$ = 1.0 Btu/lbm-°F
$T_{cw\text{-}in}$ = 92°F
$T_{cw\text{-}out}$ = ?
$T_{oil\text{-}in}$ = 160°F
$T_{oil\text{-}out}$ = 110°F

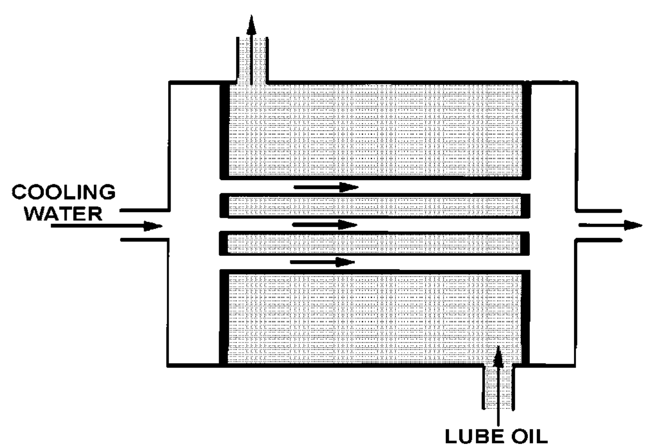
A. 110°F

B. 115°F

C. 120°F

D. 125°F

ANSWER: D.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2632 (P2633)

Refer to the drawing of a lube oil heat exchanger (see figure below).

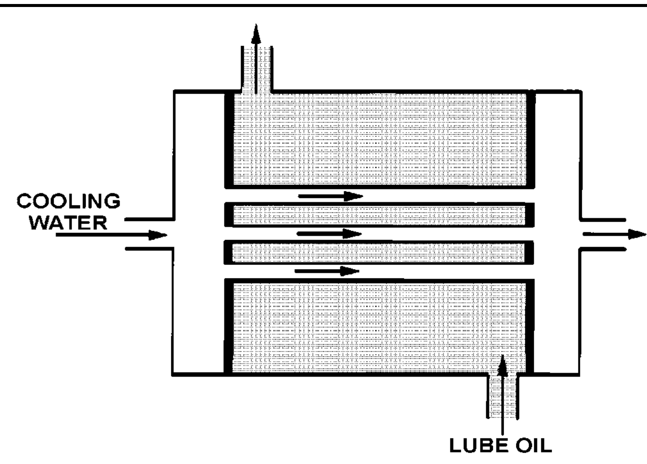
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 110°F
Cooling water inlet temperature: 75°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following sets of heat exchanger outlet temperatures is possible? (Neglect any difference between fluid specific heats.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	100°F
B.	100°F	90°F
C.	90°F	100°F
D.	90°F	90°F

ANSWER: D.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2733 (P2733)

Refer to the drawing of a lube oil heat exchanger (see figure below).

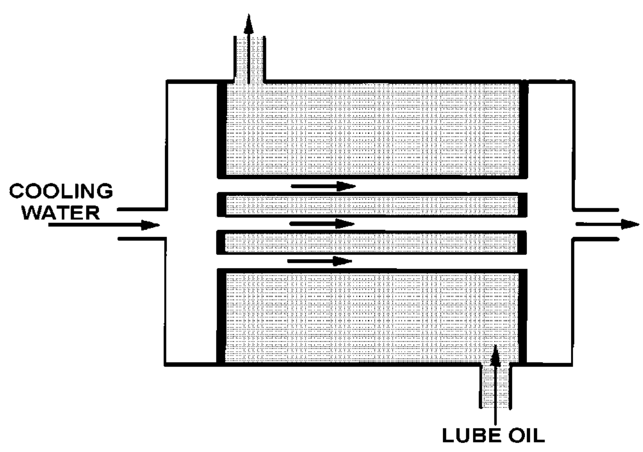
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assuming cooling water flow rate is greater than lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is <u>not</u> possible? (Assume both fluids have the same specific heat.)

	Lube Oil <u>Outlet Temp</u>	Cooling Water <u>Outlet Temp</u>
A.	90°F	86°F
B.	100°F	85°F
C.	110°F	84°F
D.	120°F	83°F

ANSWER: D.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2832

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 105°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 140°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 100°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, $T_{cw\text{-}out}$ decreases to 99°F. Assuming mass flow rate and c_p of both fluids remain the same, which one of the following will be the approximate temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

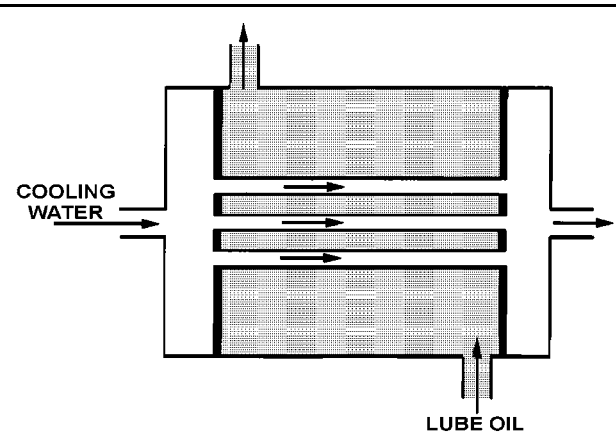
A. 99°F

B. 108°F

C. 116°F

D. 122°F

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B2933 (P2934)

Refer to the drawing of a lube oil heat exchanger (see figure below).

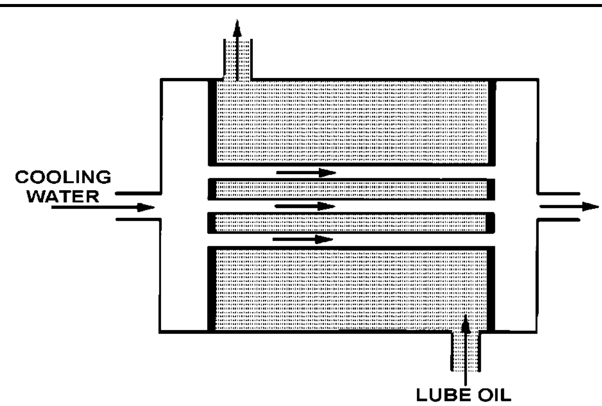
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assuming the cooling water flow rate exceeds the lube oil flow rate, which one of the following pairs of heat exchanger outlet temperatures is possible? (Assume both fluids have the same specific heat.)

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	90°F
B.	100°F	100°F
C.	110°F	90°F
D.	110°F	100°F

ANSWER: A.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B3032 (P3081)

The volumetric flow rate of cooling water entering a heat exchanger is 500 gpm.

Given the following:

Cooling water pressure entering and leaving the heat exchanger is 10 psig.
Cooling water inlet temperature is 90°F.
Cooling water outlet temperature is 160°F.
Heat exchanger inlet and outlet piping have the same diameter.

What is the approximate volumetric flow rate of the cooling water exiting the heat exchanger?

A. 496 gpm

B. 500 gpm

C. 504 gpm

D. 509 gpm

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B3431

Refer to the drawing of a lube oil heat exchanger (see figure below).

The heat exchanger is operating with the following parameters:

$C_{p\text{-oil}}$ = 1.1 Btu/lbm-°F
$C_{p\text{-water}}$ = 1.0 Btu/lbm-°F
$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 121°F
$\dot{m}_{oil}$ = 4.0×10^4 lbm/hr
$\dot{m}_{water}$ = ?

What is the mass flow rate of the cooling water?

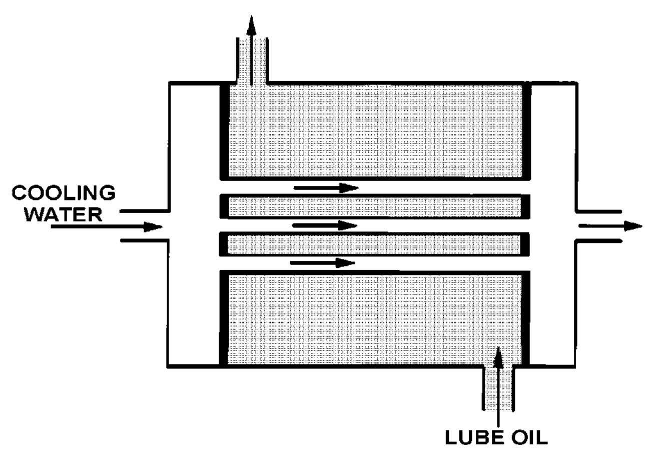
A. 8.0×10^4 lbm/hr

B. 7.3×10^4 lbm/hr

C. 2.6×10^4 lbm/hr

D. 2.2×10^4 lbm/hr

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B3732 (P3732)

Refer to the drawing of a lube oil heat exchanger (see figure below).

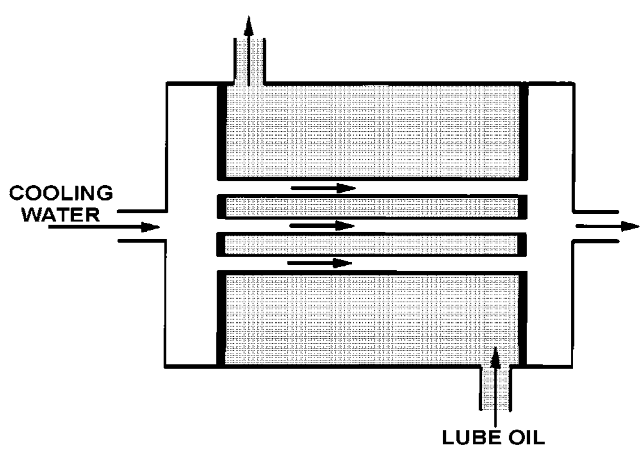
The lube oil heat exchanger is in service with the following inlet temperatures:

Lube oil inlet temperature: 130°F
Cooling water inlet temperature: 70°F

Assume that cooling water mass flow rate is less than lube oil mass flow rate, and that both fluids have the same specific heat. Which one of the following pairs of heat exchanger outlet temperatures is <u>not</u> possible?

	Lube Oil Outlet Temp	Cooling Water Outlet Temp
A.	100°F	105°F
B.	105°F	105°F
C.	110°F	90°F
D.	115°F	90°F

ANSWER: C.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B3733 (P3783)

A condensate pump is taking suction on a main condenser hotwell, containing water at 100°F, and discharging the water at a volumetric flow rate of 100,000 gpm to the main feedwater system. The main feedwater system heats the water to 400°F before it enters the reactor vessel. Assume there is no leakage, and no bypass or recirculation flow paths are in use.

What is the approximate volumetric flow rate of the feedwater entering the reactor vessel?

A. 100,000 gpm

B. 105,000 gpm

C. 109,000 gpm

D. 116,000 gpm

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.08 [2.9/3.0]
QID: B4018 (P4016)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

Given the following initial parameters:

Cooling water inlet temperature ($T_{cw\text{-}in}$) = 75°F
Cooling water outlet temperature ($T_{cw\text{-}out}$) = 95°F
Oil inlet temperature ($T_{oil\text{-}in}$) = 150°F
Oil outlet temperature ($T_{oil\text{-}out}$) = 120°F

Air introduction to the heat exchanger results in some of the heat exchanger tubes becoming uncovered. As a result, $T_{cw\text{-}out}$ decreases to 91°F. Assume the inlet temperatures, mass flow rates, and specific heats of both fluids remain the same.

Which one of the following will be the new approximate temperature of the oil exiting the heat exchanger ($T_{oil\text{-}out}$)?

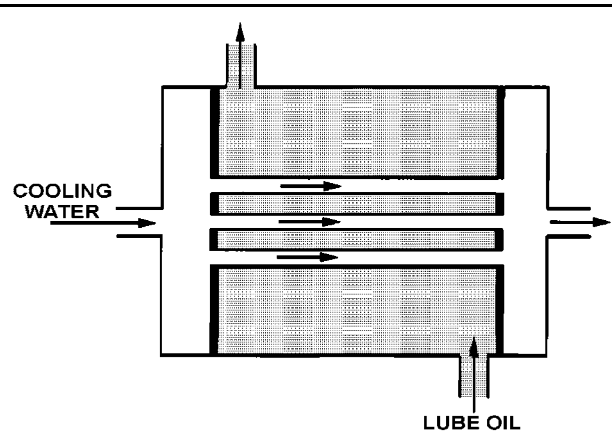
A. 126°F

B. 130°F

C. 134°F

D. 138°F

ANSWER: A.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.09 [2.7/2.8]
QID: B232

A reactor is shut down with a reactor coolant temperature of 400°F and all control rods fully inserted. What is the <u>major</u> adverse consequence resulting from rapidly reducing the reactor coolant temperature to 250°F?

A. Excessive stress in the ceramic fuel pellets of the reactor core

B. Excessive stress on the reactor vessel wall

C. Uncontrolled reactor criticality

D. Loss of core inlet subcooling

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.09 [2.7/2.8]
QID: B633

Steam has been admitted to a condenser for 25 minutes with no cooling water during a condenser startup. Initiating full cooling water flow rate at this time will...

A. reduce the stress on the condenser shell by rapidly cooling the shell.

B. reduce the stress on the condenser tubes by rapidly cooling the tubes.

C. induce large thermal stresses on the condenser shell.

D. induce large thermal stresses on the junctions between the condenser tubes and the tubesheet.

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B32

A plant is operating at full power with 2°F of condensate subcooling. Which one of the following changes will decrease subcooling of the condensate entering the main condenser hot well? (Assume condensate temperature does not change.)

A. Decreased circulating water flow rate

B. Increased gas buildup in the main condenser

C. Decreased main condenser hotwell level

D. Decreased main turbine steam flow

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B111 (P1834)

During normal reactor operation, a main condenser develops an air leak which decreases vacuum at a rate of 1 inch Hg/min. Which one of the following would increase because of this condition?

A. Extraction steam flow rate

B. Condenser hotwell temperature

C. Low pressure turbine exhaust steam moisture content

D. Steam cycle efficiency

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B733

Which one of the following changes will result in increased subcooling of the condensate water in the condenser hot well?

A. Decrease circulating water flow.

B. Increase circulating water temperature.

C. Decrease the main turbine generator MW load.

D. Isolate one bay of the condenser circulating water system.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B1135 (P2480)

The primary reason for slowly opening the discharge valves of large motor-driven centrifugal cooling water pumps after starting the pumps is to minimize the...

A. net positive suction head requirements.

B. potential for a water hammer.

C. motor running current requirements.

D. potential for pump cavitation.

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B1232

Assuming that condenser cooling water inlet temperature and flow rate do not change, if condenser vacuum improves, condensate temperature will...

A. increase because condensate subcooling has decreased.

B. increase because condenser saturation pressure has increased.

C. decrease because condensate subcooling has increased.

D. decrease because condenser saturation pressure has decreased.

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B2133

During normal plant operation at 100% power, a main condenser develops an air leak that degrades vacuum at a rate of 1 inch Hg/min. Assuming the plant continues to operate at 100% power, condenser hotwell temperature will...

A. increase because condensation of turbine exhaust steam is occurring at a higher temperature.

B. increase because more work is being extracted from the steam by the turbine.

C. decrease because condensation of turbine exhaust steam is occurring at a lower temperature.

D. decrease because less work is being extracted from the steam by the turbine.

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B2633 (P2634)

A nuclear power plant is operating at steady-state 100% power. Assuming that condenser cooling water inlet temperature and flow rate do not change, if condenser vacuum decreases, condensate temperature will...

A. increase because condensate subcooling has decreased.

B. increase because condenser saturation pressure has increased.

C. decrease because condensate subcooling has increased.

D. decrease because condenser saturation pressure has decreased.

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.10 [2.8/2.8]
QID: B2736 (P3534)

A nuclear plant is operating at steady-state 100% power when air inleakage causes main condenser vacuum to decrease from 28 inches Hg to 27 inches Hg. Assume the steam inlet quality and mass flow rate of steam through the main turbine remain <u>unchanged</u>, and that condenser cooling water inlet temperature and flow rate do <u>not</u> change.

When the plant stabilizes, turbine exhaust quality will be_________ and turbine exhaust temperature will be _________.

A. higher; higher

B. higher; lower

C. lower; higher

D. lower; lower

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.11 [2.8/2.8]
QID: B374

A pressure gauge on a condenser reads 27 inches of mercury (Hg) vacuum. What is the absolute pressure corresponding to this vacuum? (Assume that standard atmospheric pressure equals 15 psia.)

A. 1.0 psia

B. 1.5 psia

C. 13.5 psia

D. 14.0 psia

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.11 [2.8/2.8]
QID: B434

A steam-driven turbine exhausts to a condenser. As condenser vacuum is <u>increased</u>, the turbine backpressure will _________ and the turbine power output will _________.

A. increase; increase

B. increase; decrease

C. decrease; increase

D. decrease; decrease

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.11 [2.8/2.8]
QID: B835

A pressure gauge on a main condenser reads 2 psiv. What is the approximate absolute pressure in the main condenser?

A. 2 psia

B. 13 psia

C. 15 psia

D. 17 psia

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.11 [2.8/2.8]
QID: B1035

A condenser absolute pressure of 4 inches Hg is equivalent to...

A. 11 inches Hg vacuum.

B. 13 inches Hg vacuum.

C. 26 inches Hg vacuum.

D. 28 inches Hg vacuum.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.11 [2.8/2.8]
QID: B1633

Which one of the following is the approximate condenser vacuum when condenser pressure is 7 inches Hg absolute?

A. 0 inches Hg vacuum

B. 7 inches Hg vacuum

C. 23 inches Hg vacuum

D. 30 inches Hg vacuum

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.11 [2.8/2.8]
QID: B2131

Which one of the following is the approximate condenser vacuum (inches Hg vacuum) when condenser pressure is 16 inches Hg absolute?

A. 4 inches Hg vacuum

B. 8 inches Hg vacuum

C. 12 inches Hg vacuum

D. 14 inches Hg vacuum

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.12 [2.9/3.0]
QID: B1133

A reactor is shut down at 400 psia during a maintenance outage when all forced decay heat removal is lost. Which one of the following will enhance natural circulation within the reactor vessel?

A. Increasing reactor vessel pressure to 500 psia

B. Increasing reactor vessel water level above the steam separators

C. Decreasing reactor vessel pressure to 300 psia

D. Decreasing reactor vessel water level to just above the top of the core

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B34

What is the saturation temperature for a boiling water reactor operating at 920 psig?

A. 532.6°F

B. 533.9°F

C. 536.5°F

D. 538.4°F

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B534

Which one of the following is the state of water at 20 psia and 250°F?

A. Subcooled liquid

B. Saturated liquid

C. Mixture of saturated liquid and vapor

D. Superheated vapor

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B1335

Which one of the following describes the state of water at 35 psia and 240°F?

A. Subcooled liquid

B. Saturated liquid

C. Mixture of saturated liquid and vapor

D. Superheated vapor

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B1433

Which one of the following is the state of water at 120 psig and 340°F?

A. Subcooled liquid

B. Saturated liquid

C. Mixture of saturated liquid and saturated vapor

D. Superheated vapor

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B1536

Which one of the following describes the state of water at 160 psig and 366°F?

A. Saturated liquid

B. Subcooled liquid

C. Superheated vapor

D. Mixture of saturated liquid and vapor

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B2336

Which one of the following describes the state of water at 160 psig and 372°F?

A. Saturated liquid

B. Subcooled liquid

C. Superheated vapor

D. Mixture of saturated liquid and vapor

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.13 [2.7/2.9]
QID: B2834

Which one of the following describes the state of water at 150 psig and 360°F?

A. Saturated liquid

B. Subcooled liquid

C. Superheated vapor

D. Mixture of saturated liquid and vapor

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B535

What is the reason for ensuring that a piping system is completely filled and vented <u>prior</u> to initiating system flow?

A. To minimize the system head losses

B. To ensure all noncondensible gases are removed from the piping system to reduce system corrosion

C. To preclude a reduction in the overall system heat transfer coefficient

D. To minimize the potential for water hammer

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B635

The discharge valve for a large operating centrifugal pump should be positioned slowly to minimize the...

A. change in available net positive suction head.

B. potential for causing water hammer.

C. differential pressure stress exerted on the valve disk and stem.

D. mechanical wear on the valve seat and stem packing.

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.15 [2.6/2.8]
QID: B3635 (P3633)

A main turbine-generator is operating at 80% load with the following <u>initial</u> steady-state temperatures for the main turbine lube oil heat exchanger:

$T_{oil\ in}$ = 174°F
$T_{oil\ out}$ = 114°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

After six months of main turbine-generator operation, the following <u>final</u> steady-state lube oil heat exchanger temperatures are observed:

$T_{oil\ in}$ = 179°F
$T_{oil\ out}$ = 119°F
$T_{water\ in}$ = 85°F
$T_{water\ out}$ = 115°F

Assume that the final cooling water and lube oil flow rates are the same as the initial flow rates, and that the specific heat values for the cooling water and lube oil do <u>not</u> change.

Which one of the following could be responsible for the differences between the initial and final heat exchanger steady-state temperatures?

A. The heat exchanger tubes have become fouled with scale.

B. The temperature of the cooling water source has increased.

C. The final main turbine-generator load is higher than the initial load.

D. The final main turbine-generator load is lower than the initial load.

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.16 [2.5/2.6]
QID: B156

The buildup of scale on heat-transfer surfaces in the reactor vessel...

A. results in lower fuel temperature, which decreases the nuclear fuel cycle efficiency.

B. is controlled by complying with core thermal limits and adhering to fuel preconditioning requirements.

C. is controlled by using reactor water cleanup system and condensate system demineralizers.

D. results in higher coolant temperature, which increases overall plant efficiency.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.16 [2.5/2.6]
QID: B1136

Tube scaling in a parallel flow heat exchanger causes heat transfer rate to decrease because the...

A. surface area of the tubes decreases.

B. cooling fluid outlet temperature decreases.

C. thermal conductivity of the scale is very low.

D. flow through the heat exchanger becomes more turbulent.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.16 [2.5/2.6]
QID: B1234 (P32)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If scaling occurs inside the cooling water tubes, cooling water outlet temperature will __________ and lube oil outlet temperature will __________. (Assume oil and cooling water flow rates remain the same.)

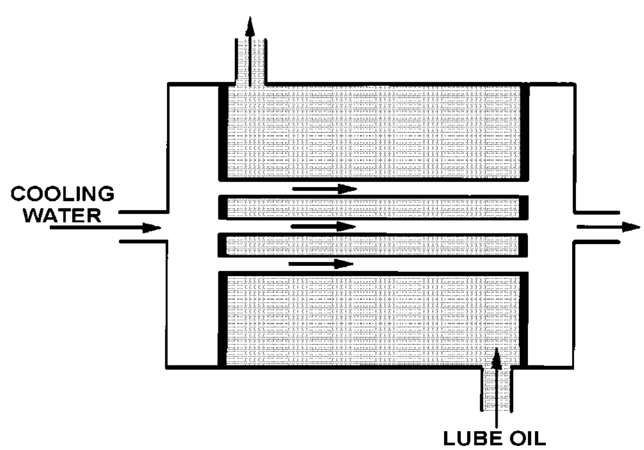
A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase

ANSWER: B.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.16 [2.5/2.6]
QID: B1833 (P2233)

Refer to the drawing of an operating lube oil heat exchanger (see figure below).

If deposits accumulate on the outside of the cooling water tubes, cooling water outlet temperature will __________ and oil outlet temperature will __________. (Assume oil and cooling water inlet temperatures and flow rates remain the same.)

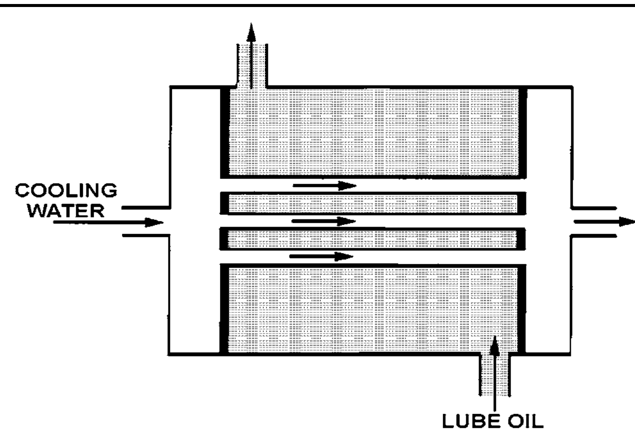
A. increase; decrease

B. increase; increase

C. decrease; decrease

D. decrease; increase

ANSWER: D.



LUBE OIL HEAT EXCHANGER

TOPIC: 291006
KNOWLEDGE: K1.17 [2.7/2.8]
QID: B234

Refer to the drawing of an operating cooling water system (see figure below) that is transferring heat between a low pressure (LP) and high pressure (HP) water system.

Which one of the following effects will initially occur as a result of a tube failure in the heat exchanger?

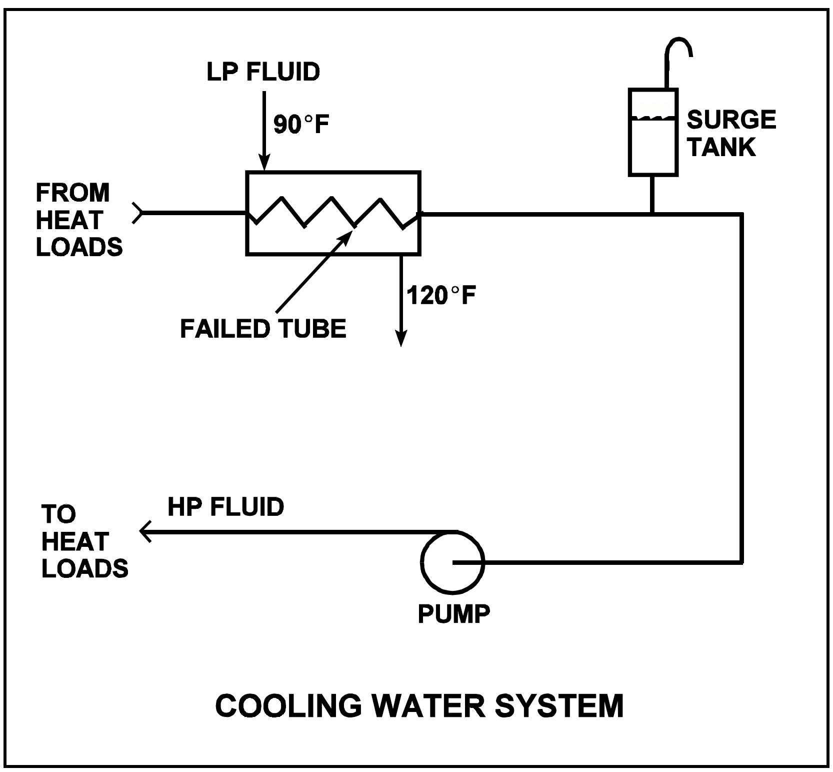
A. Level in the surge tank will increase.

B. HP fluid pump flow rate will decrease.

C. HP fluid heat exchanger differential temperature will increase.

D. LP fluid heat exchanger outlet temperature will increase.

ANSWER: D.



TOPIC: 291006
KNOWLEDGE: K1.17 [2.7/2.8]
QID: B332 (P331)

During normal steady-state plant operation with a constant generator load, plugging of 1% of the tubes in the main condenser will cause absolute pressure in the condenser to ______________ and hotwell temperature to ______________.

A. increase; increase

B. decrease; increase

C. increase; decrease

D. decrease; decrease

ANSWER: A.

TOPIC: 291006
KNOWLEDGE: K1.17 [2.7/2.8]
QID: B333 (P333)

A nuclear power plant is operating normally at 50% of rated power. Which one of the following will result from a cooling water tube rupture in the main condenser?

A. Increased condenser vacuum

B. Increased conductivity of the condensate

C. Decreased condensate pump net positive suction head

D. Decreased condensate pump flow rate

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.17 [2.7/2.8]
QID: B1535 (P1234)

Refer to the drawing of a cooling water system (see figure below).

Which one of the following will occur as a result of the indicated tube failure in the heat exchanger?

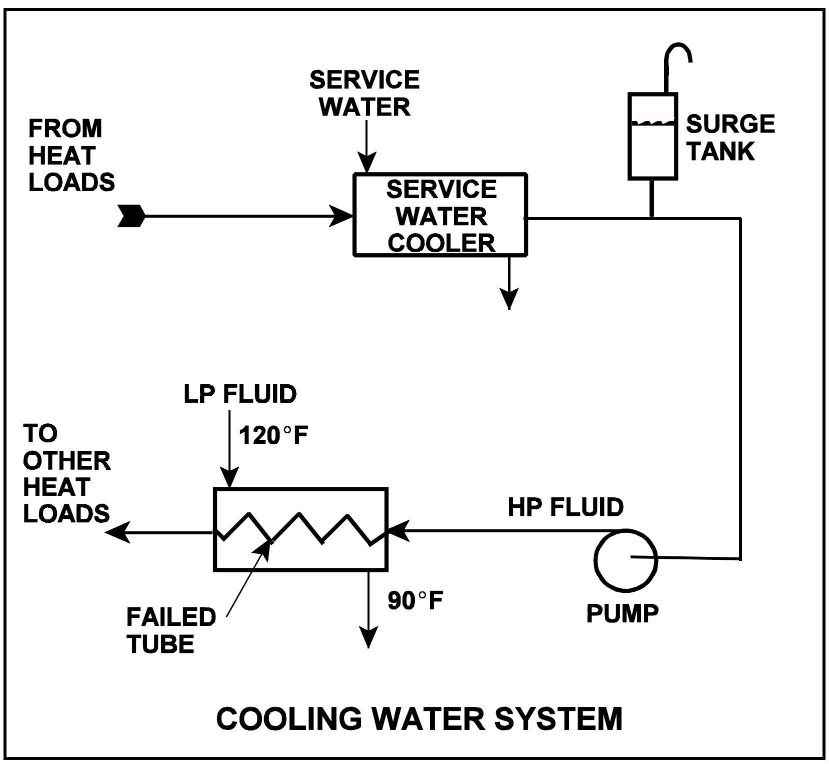
A. High pressure (HP) fluid inventory increases.

B. Pressure in the low pressure (LP) system decreases.

C. Temperature in the low pressure (LP) system increases.

D. Level in the surge tank decreases.

ANSWER: D.



TOPIC: 291006
KNOWLEDGE: K1.17 [2.7/2.8]
QID: B1931 (P1134)

Which one of the following effects will occur as a result of multiple tube failures (leaks) in the main condenser with the plant at 50% power? (Assume condenser vacuum does not change.)

A. Condensate depression will decrease.

B. Condensate conductivity will increase.

C. Condensate oxygen concentration will decrease.

D. Condenser inlet cooling water flow rate will decrease.

ANSWER: B.

TOPIC: 291006
KNOWLEDGE: K1.17 [2.7/2.8]
QID: B3535 (P234)

Refer to the drawing of an operating cooling water system (see figure below).

Which one of the following effects would occur as a result of the failed tube in the heat exchanger?

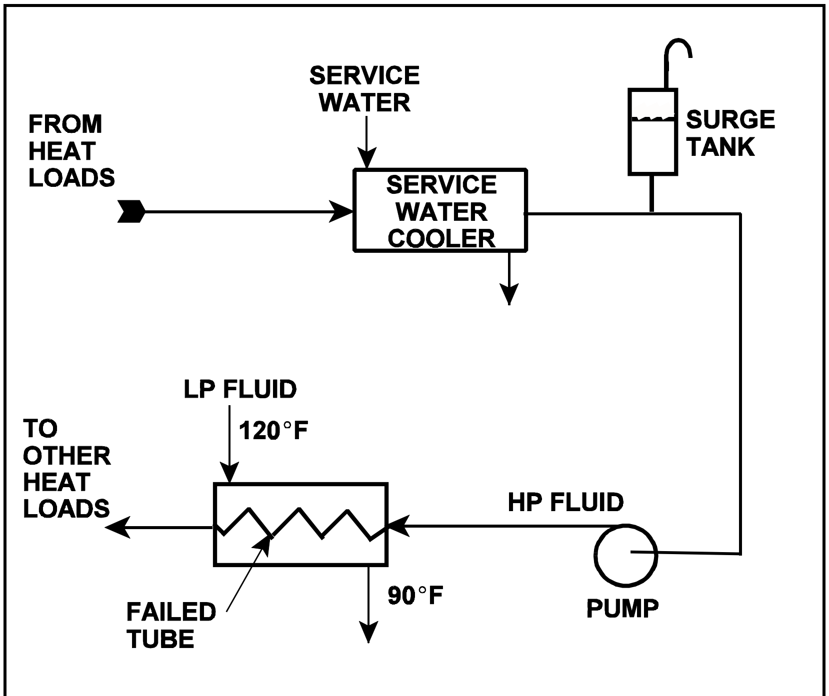
A. Level in the surge tank increases.

B. Flow in the low pressure system reverses.

C. Pressure in the low pressure system decreases.

D. Low pressure fluid heat exchanger outlet temperature decreases.

ANSWER: D.



COOLING WATER SYSTEM

TOPIC: 291006
KNOWLEDGE: K1.18 [2.8/2.9]
QID: B936 (P1912)

During normal nuclear power plant operation, why does air entry into the main condenser reduce the thermodynamic efficiency of the steam cycle?

A. The rate of steam flow through the main turbine increases.

B. The condensate subcooling in the main condenser increases.

C. The enthalpy of the low pressure turbine exhaust increases.

D. The air mixes with the steam and enters the condensate.

ANSWER: C.

TOPIC: 291006
KNOWLEDGE: K1.18 [2.8/2.9]
QID: B1236

During power plant operation, the accumulation of air and non-condensable gases in the main condenser will...

A. not effect turbine work.

B. not effect turbine efficiency.

C. increase generator load.

D. increase turbine backpressure.

ANSWER: D.

TOPIC: 291006
KNOWLEDGE: K1.18 [2.8/2.9]
QID: B2235 (P2834)

A nuclear power plant is operating at 100% power when air inleakage results in the buildup of noncondensible gases in the main condenser. Which one of the following will decrease as a result of this air inleakage?

A. Condensate temperature

B. Pressure in the main condenser

C. Suction pressure at the condensate pumps

D. Condenser cooling water outlet temperature

ANSWER: D.